

Progress with STAR C++ Offline Software

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- Ground Rules
- Platforms and Problems
- Software and Package Developments

C++ Developments in STAR

Ground Rules for Offline Software:

- Define Class Libraries

- * adaptation of guidelines from CERN
- * use ONLY STANDARD C++ LIBRARY (STL)
- * no *Tools.h++*
- * CLHEP (more about this later...)
- * 1 compiler per platform

- Follow the ANSI Standard

- * STL's have some variations between vendors
- * currently few vendors have compliant compilers...

STAR Supported Platforms

Platforms used for code development in STAR:

Platform	O/S	C++ compiler
Sun	Solaris 2.5.1	CC (v4.2)
Intel	(Red Hat 5.0) Linux	egcs (v1.0.2)
HP	HP-UX 10.20	aCC (v1.12)

- **HP-aCC is ANSI compliant**
- **egcs is used on LINUX platforms**
- **Solaris does not provide an STL**
- **MS Visual C++ is not ANSI compliant**

STAR Supported Platforms

Details...

- **HP-aCC is ANSI compliant**
- **egcs is used on LINUX platforms**
 - * egcs (v1.0.2) and gcc (v2.8.1) are both close to ANSI compliant
 - Exception Handling not fully supported
 - Few things i.e. <numeric_limits> are missing
 - * egcs (v1.0.2) has a better organized Standard Library
 - * gcc (v2.7.2) lacks MANY ANSI features
 - Newer SGI-STL adapted for v2.8.1 performs much better
 - Does not support member templates
- **Solaris does not provide an STL**
 - * SUN CC is **FAR FROM ANSI COMPLIANT**
 - * **MANY FEATURES MISSING**
 - * Object Space free distribution is old and **NOT** in compliance with ANSI
 - * Rogue Wave provides an implementation which is being investigated
- **MS Visual C++ is not ANSI compliant**
 - * Poor support of member templates

A STAR Class Library

STAR feels it is very desirable to have common software tools in the HEP community. In Particular CLHEP which defines common HEP tools like:

- **Three Vector**
- **Lorentz Vector**
- **Matrices**

The tools currently available do not reflect the recent
STANDARDIZATION...

- **No need to redefine standard containers i.e.**
 - * **Alist**
 - * **String**
- **Little flexibility in optimizing types for storage and precision**
 - * **Vectors and Matrices have elements of fixed type**
 - **ThreeVector(double x, double y, double z)**
 - * **Easily overcome with use of templated classes**
- **Extensive Random Number generators are very useful!**

Development of A STAR Class Library

In order to address these concerns, STAR has developed a new version of CLHEP which utilizes the most recent features and standardizations:

- **Templates**
- **Exceptions**
- **Standard Containers**

These developments are being made in consultation with CERN LHC++ collaboration and are actively discussed a listserver: *cern-clhep@listbox1.cern.ch*

Code which retains backward compatibility with CLHEP v1.2 without defining redundant containers exists and is being used in other projects. It compiles and runs on:

- **HP-aCC v1.12**
- **HP-gcc v2.8.1**
- **Red-Hat Linux-egcs v1.0.2**
- **Sun-CC(v4.2) with ObjectSpace (v2.0)**

The STAR Class Library

Contains...

- **StThreeVector<T>**
- **StLorentzVector<T>**
- **StMatrix<T>**
- **Random**
 - * Defines Random Number Generation Engines and Distributions
Flat, Gaussian, Poisson, Exponential, Breit-Wigner
- **StHelix**
 - * Defines a Helix in 3 dimensions according to the STAR parameterization
- **StPhysicalHelix**
 - * Defines a Physical Track Model according to the STAR parameterization
- **Utilities**
 - * Defines a parser and prompt for user input
- **SystemOfUnits**
 - * Defines a consistent set of SI units
- **PhysicalConstants**
 - * Defines an extended set of physical Constants

Extensive Documentation and examples that demonstrate the functionality and user implementations exist. See:

http://www.rhic.bnl.gov/STAR/html/comp_l/simu/TpcRespSim/src/SCLdoc.ps

Development of A STAR Class Library

Technical Problems have slowed development with:

- **Sun-Solaris v2.5.1**

- * **No ANSI compliant STL**
- * **Using hacked version of ObjectSpace free distribution which we DO NOT want to maintain in the long term**

- **MSV-C++ v5.0**

- * **No ANSI compliant STL**
- * **Very poor template support**

- **Red-Hat Linux-gcc v2.8.1**

- * **No ANSI compliant STL**
- * **No functional exception handling**
- * **Complicated dependencies lead to ambiguities in compilation**

C++ Software Developments

The STAR Class Library is being used in the development of a fully Object Oriented TPC Response Simulator. See:

http://www.rhic.bnl.gov/STAR/html/comp_l/simu/TpcRespSim/src/Welcome.html

The goals of the project was to develop a pilot package defining standards along the way. This is more or less completed with the result being the **StarClassLibrary**.

Heavy use of **Rational Rose** was made in the development and design.

Coding and testing are well underway!!